

CLAIMS

Having thus described the invention, what I desire to claim and secure by letters patent is:

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A reinforced plastic composite pressure vessel for containment of fluids which may be under pressure, said pressure vessel comprising:

- a) a pair of shell sections made from a reinforced plastic composite material with each having a cylindrical side wall and one end wall thereon along with an open opposite end;
- b) a reinforcing region adjacent and surrounding the open end of each of said shell sections and which reinforcing regions cooperate to enable said shell sections to be joined together and thereby form a unitary reinforced plastic composite pressure vessel;
- c) said shell sections having opposing and matching ends which are adapted to be abutted together to form a complete shell; and
- d) a joinder ring fitted within the open ends of each of said shell sections when said shell sections are brought together in abutting relationship and which ring engages the reinforcing regions at the open ends of each of said shell sections and thereby allows for complete sealing

attachment of the two shell sections together to form
said vessel.

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5 The reinforced plastic composite vessel for containment of
fluids of Claim 1 further characterized in that said shell sections
together comprise an inner shell wall of the vessel and that an
outer shell wall is disposed about said inner shell wall and is
secured thereto.

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15 The reinforced plastic composite vessel for containment of
fluids of Claim 3 further characterized in that said outer shell
wall is formed by applying of filament containing reinforcing
material about said inner shell.

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20 The reinforced plastic composite vessel for containment of
fluids of Claim 1 further characterized in that said joinder ring
has surfaces which match and engage surfaces of said reinforcing
regions and enable said shell sections to be joined together to
thereby form said vessel.

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25 The reinforced plastic composite vessel for containment of
fluids of Claim 1 further characterized in that said reinforcing

regions in each of said shell sections have tapered surfaces and the joinder ring has similarly tapered surfaces which match and engage the tapered surfaces of each of said shell sections and lie in close fitting contact therewith when the two shell sections are brought together in abutting engagement.

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The reinforced plastic composite vessel for containment of fluids of Claim 1 further characterized in that said joinder ring is formed of a reinforced plastic composite material.

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The reinforced plastic composite vessel for containment of fluids of Claim 3 further characterized in that said outer shell is integrally bound to said inner shell.

A relatively low weight and high performance, liner-less pressure vessel capable of retaining fluid under pressure in adverse environmental conditions, said vessel comprising:

- a) a preformed unitary vessel having a side wall and end members integral therewith to thereby form an interior chamber, and which vessel is divided into a pair of separate and engageable vessel shell sections;
- b) end fittings cured to interior surfaces of the end members of said vessel and being integral therewith;
- c) a joinder ring located within each of said shell sections when brought together and being secured to said shell sections to form a complete unitary vessel.

The relatively low weight, high performance and liner-less pressure vessel of Claim 8 further characterized in that said shell sections each comprise a cylindrical reinforcing ring at the open ends of the said shell sections and having mating surfaces thereon; and said joinder ring also having mating surfaces which match the mating surfaces of said reinforcing rings.

The relatively low weight, high performance and liner-less pressure vessel of Claim 8 further characterized in that said

vessel has an outer shell which is secured to and disposed thereabout and completely encloses same.

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5 The relatively low weight, high performance and liner-less pressure vessel of Claim 10 further characterized in that said outer shell is filament wound on the vessel and secured thereto.

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A high performance liner-less pressure vessel formed primarily of fiber reinforced plastic composite material and comprising:

- a) a fully cured filament wound reinforced plastic composite inner shell formed of a relatively minimal thickness but of a thickness sufficient to carry a portion of an induced pressure load in said vessel;
- b) a filament wound reinforced plastic composite outer shell which is filament wound around said inner shell and completely covers said inner shell, said outer shell having a thickness to carry a substantial portion of any induced pressure load;
- c) said inner shell being fully bonded to said outer shell forming a shell composite with a cylindrical side wall and end walls thereon;
- d) an open port formed in each of said end walls; and
- e) end fittings secured to the interior and exterior of said composite shell and extending outwardly therefrom, said end fittings being completely sealed against the interior surface of said inner shell in regions surrounding the ports at said end walls.

A high performance linerless pressure vessel formed primarily of fiber reinforced plastic composite material of Claim 12, further characterized in that said inner shell is comprised of two sections

which are joined together by an interior joinder ring, and said joinder ring has surfaces which match and engage surfaces of said shell sections and enable said shell sections to be joined together.

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The high performance liner-less pressure vessel formed primarily of fiber reinforced plastic composite material of Claim 13 further characterized in that said inner shell is integrally bonded to said outer shell and together form a unitary shell.

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The high performance liner-less pressure vessel formed primarily of fiber reinforced plastic composite material of Claim 13 further characterized in that a barrier film is secured to and substantially covers the full inner surface of the inner shell.

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The high performance liner-less pressure vessel formed primarily of fiber reinforced plastic composite material of Claim 13 further characterized in that said cylindrical side wall has a split line on the interior thereof.

A method of making a liner-less reinforced plastic composite pressure vessel, said method comprising:

- a) forming a reinforced plastic composite inner shell of said vessel and which is comprised of a side wall and a pair of end domes;
- b) separating said inner shell into a pair of shell sections;
- c) installing interior components in said shell sections;
- d) rejoining said shell sections at the region of separation to form a unitary inner shell; and
- e) producing an outer shell about said inner shell and which outer shell constitutes a load bearing shell.

The method of making a liner-less reinforced plastic composite pressure vessel of Claim 17 further characterized in that said method comprises winding fiber containing reinforcing material about said inner shell in order to produce said outer shell thereon.

The method of making a liner-less reinforced plastic composite pressure vessel of Claim 17 further characterized in that said method comprises joining said shell sections together with a joiner ring therefor.

The method of making a liner-less reinforced plastic composite pressure vessel of Claim 17 further characterized in that said
5 shell sections have inner surfaces adapted to match the joinder ring and which allows the joinder ring to become permanently bonded to each of the shell sections.

10 The method of making a liner-less reinforced plastic composite pressure vessel of Claim 17 further characterized in that the method comprises installing a barrier film around the interior surface of said inner shell.

15 The method of making a liner-less reinforced plastic composite pressure vessel of Claim 17 further characterized in that said method comprises installing end fittings on each of said end walls from the interior of said inner shell, and which become permanently
20 bonded to said inner shell.

The method of making a liner-less reinforced plastic composite pressure vessel of Claim 17 further characterized in that an outer
25 shell is wound about said inner shell and completely covers and

encloses said inner shell, said outer shell carrying a substantial portion of any pressure load from containment of fluid therein.

A method of making a liner-less reinforced plastic composite pressure vessel, said method comprising:

- a) forming a reinforced plastic composite inner shell of said vessel and which is comprised of a side wall and a pair of end walls;
- b) separating said inner shell into a pair of shell sections, with each being an open end opposite the end wall of that section;
- c) providing a joinder ring at the interior surface of each of said shell sections when abutted together at the open ends thereof and which allows for securement of the said shell sections together to thereby form a unitary vessel, said joinder ring having surfaces which mate with surfaces on said shell sections adjacent the open ends; and
- d) permanently bonding said ring to said shell sections to thereby form a unitary shell.

A method of making a liner-less reinforced plastic composite pressure vessel of Claim 24 further characterized in that the step of bonding the joinder ring to the two shell sections comprises joining of tapered edges on said ring to tapered reinforcing areas adjacent the open ends of said shell sections.

A method of making a liner-less reinforced plastic composite pressure vessel of Claim 24 further characterized in that said method comprises causing the joinder ring and the two shell sections when assembled together to provide a bonded reinforced plastic composite structure.

A method of making a liner-less reinforced plastic composite pressure vessel of Claim 24 further characterized in that said method comprises installing certain vessel components in the interior of said vessel before joining the two shell sections together.

A method of making a liner-less reinforced plastic composite pressure vessel adapted for high altitude or outer space use of Claim 24 further characterized in that said method comprises over wrapping said assembled unitary shell with additional reinforced plastic composite material.